ulated tips in about the quantity of 16 per cent., while in stimulated tips it is present to the extent of about 20 per cent. Such figures can be obtained with considerable accuracy by an improved application of the silver reduction test. The increased reduction of an ammoniacal solution of silver nitrate following stimulation (geotropic or phototropic) can be positively shown to be due to the increased quantity of homogentisinic acid. The oxidation of this acid is accomplished in ordinary metabolism by an enzyme, which because of its activity with phenol is called phenolase. The normal activity of this enzyme prevents accumulation of homogentisinic acid above *c.* 16 per cent. In consequence of stimulation, however, there arises a substance (*de novo* so far as our knowledge now goes) which inhibits the activity of the enzyme, and thus the accumulation of homogentisinic acid up to 20 per cent. is indirectly permitted This new substance is called anti-enzyme. For different organs of the same individual and for different individuals of close systematic relationship this anti-enzyme is identical. With decreasing relationship, however, the actual substance of the anti-enzyme seems to differ, though the function remains constant. Chloroform narcosis, suffocation, antipyrin, acids, alkalies, various traumatic influences, mechanical interference with growth, and universal illumination all gave negative results for an anti-enzyme. Thus the author believes that this increased reduction of silver following stimulation is a safe and reliable test for tropistic sensation.—RAYMOND H. POND.

Behavior of liverworts in darkness.—NĚMEC has been experimenting with certain bryophytes which will grow in darkness and are not geotropic, to see what light they can throw on the mode of perception of geotropic stimulus, the biological significance of etiolation, and spontaneous nutations.[14] He finds different species behave very differently in darkness; some do not grow, others make a little growth but show no etiolation, while yet others grow long and vigorously and become markedly etiolated. Of the last, most are geotropic and grow erect or obliquely upward. But *Lejeunea bidentata* and *L. serpyllifolia* are ageotropic, having no starch or other statoliths. In darkness their shoots are completely unoriented, being at first hyponastic and then nutating irregularly. The same disorientation is observable in the sporogone of *Aneura pinguis*, but the vegetative shoots are geotropic and contain abundant statolith starch. The sporogone of *Pellia calycina* behaves similarly, but is slightly geotropic at first, losing this during elongation of the seta, which contains still some starch diffused between cell wall and vacuole and of slight mobility. The sporogone of *Pellia epiphylla*, on the contrary, is strongly geotropic and has abundant mobile starch. The sporogones of the three last named are strongly positively phototropic, and the reaction is in no way connected with the capsule. Also the upper part of the seta may be cut off, neither wound shock (which is transient) nor removal interfering with the reaction. The vegetative shoots of *Pellia calycina* grow well (plagi-

[14] NĚMEC, B., Die Wachsthumsrichtungen einiger Lebermoose. Flora **96**:409–450. *figs.* 9. 1906.

otropically) in darkness, and give a very characteristic geotropic reaction, having abundant statolith starch. *P. epiphylla* generally does not grow in darkness. Neither these two nor *Lophocolea bidentata* are geotropic in light. The behavior in darkness of *P. epiphylla*, the two species of Lophocolea, and the sporogone of Aneura must be considered as purposeless.

The researches appear to strengthen the statolith theory of geotropic perception.—C. R. B.

Photosynthesis.—USHER and PRIESTLY, having shown in a previous paper[15] that CO_2 may be decomposed in plants independently of enzymic or "vital" activity provided the products (H_2O_2 and H·COH) are removed, have now devised an arrangement by which photolysis of CO_2 can be produced *in vitro*.[16] By covering gelatin plates, or even water, with a very thin uniform layer of chlorophyll deposited from solution, and placing the glass plate or the shallow dish of water carrying the film in a vessel with CO_2 and illuminating it, they found formaldehyde produced and were able to recover identifiable quantities. By making up the gelatin with an aqueous solution of a catalase, the hydrogen peroxid also produced was decomposed with the evolution of O_2, 2^{cc} being obtained in one case. The chlorophyll was gradually bleached, in harmony with the view that it acts as a sensitizer and is destroyed in the process of photolysis. Synthesis of H·COH into carbohydrate was found in the earlier paper to be dependent on the healthy condition of the protoplast, and feeding experiments have already shown that H·COH when supplied in very dilute form can be condensed by green plants if illuminated. The authors painted the white petals of *Saxifraga Wallacei* with chlorophyll, and floated them on water charged with CO_2 in light. In the course of a day they were found to contain starch. Thus they secured photosynthesis by a different (though inefficient) arrangement of the mechanism of a green leaf.

Further study was made of photolysis of CO_2 in the presence of uranium salts. They have direct evidence of the production of formic acid (which also is produced under some conditions in the plant as an intermediate product in the reduction of CO_2), but they were unable to isolate and identify formaldehyde.

These papers record a most important step in solving the problems of photosynthesis.—C. R. B.

Vascular anatomy of cycads.—Two years ago MATTE published his thesis on the vascular anatomy of the cycads,[17] in which he presented in great detail, with copious illustrations, the vascular anatomy of the leaves and flowers in representative species of all the nine genera; and of the seedlings of *Dioon edule*, *Cycas*

[15] USHER, F. L., and PRIESTLY, J. H., A study of the mechanism of carbon assimilation in green plants. Proc. Roy. Soc. London B. **77**:369–376. 1905.

[16] ——The mechanism of carbon assimilation in green plants: the photolytic decomposition of carbon dioxid *in vitro*. *Idem* **78**:318–327. 1906.

[17] MATTE, H., Recherches sur l'appareil libero-ligneux des Cycadées. pp. 233. *pls. 16. figs. 264.* 1904.